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A SIMPLIFIED SHORT-TIME METHOD FOR MAKING CHEDDAR CHEESE FROM
PASTEURIZED MILK

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A new, short-time method for making Cheddar cheese from pasteurized milk was developed and described by the U. S. Department of Agriculture in 1953 (BDI-Inf-158). It required only 2-1/2 hours from the time the rennet was added to the milk until the curd was pressed, instead of the conventional 5-1/2 to 6-1/2 hours. Furthermore, packing, cheddaring and milling the curd were eliminated. Thus, the time and amount of hand labor required in making cheese were greatly reduced. There were, however, recognized objections to certain parts of the method. It required special types of cheesemaking equipment. Also, approximately one-half of the whey was unusable because it contained 4 percent added salt. These objectionable features have been eliminated for the most part through the development of a simplified short-time method that can be used with conventional cheesemaking equipment, except for minor changes in the hoops and hooping equipment. Less than 10 percent, or none, of the whey is lost.

The simplified method was developed on a pilot-plant scale. Although it has not been used in a commercial-size operation, it has been tested thoroughly on the pilot-plant scale and is ready for trial by the industry under commercial conditions.

Briefly, the method is as follows: Two starters are used. One is the conventional Cheddar-cheese lactic starter. The other is a heat- and salt-tolerant, lactic-acid-forming streptococcus.

The starters and rennet are added to pasteurized milk at 88° F. The curd is cut and cooked to 100° F in a conventional Cheddar-cheese vat. The whey is drained off and the curd is salted. The salted curd is hooped at about 110° F in a small volume of either salted whey or salted water, drained under pressure for a few minutes, and pressed overnight in a conventional cheese press. The method requires only three hours until the curd is pressed, instead of the conventional 5-1/2 to 6-1/2 hours.

The body and texture of cheese made by this method are superior to those of high-grade cheese made by present methods. Usually the cheese is waxy and free, or almost free, of mechanical openings. An excellent mild flavor develops within three months when the cheese is cured at 55° F.

The milk used in developing the method was obtained from the herd of the Dairy Husbandry Research Branch, U.S.D.A., at Beltsville, Md. It was of high quality, contained from 3.5 to 4.5 percent butterfat, and was pasteurized by the so-called high-temperature short-time method at 161.5° to 162° F for 15 seconds or by the holding method at 150° F for 6 minutes.

The new or modified equipment used in developing the method, the starters, and the manufacturing procedure are described below.

Equipment

1. Cheese hoops. The new-style cheese hoop for rindless cheese was composed of three parts: A body, a tray-like bottom, and a follower. The body was 11 x 14 inches, inside dimensions, and 24 inches high. The bottom was 11-1/4 x 14-1/4 inches, inside dimensions, and 2-1/2 inches deep, and was fastened to the body with two pins. The follower was 10-3/4 x 13-3/4 inches. All the pieces were made of stainless steel 1/16 inch thick and were perforated with 1/4-inch holes every 2-1/2 inches on center.

The hoop body was lined with cheesecloth, with about 2 inches overlapping at each end, and the hoop bottom was covered with cheesecloth. Then the hoop body was inserted into the bottom and fastened with the pins.

Daisy, twin, or Cheddar hoops were used also. With these hoops, a bandage with a sewed-in bottom was placed on the hoop ring. A special rim 12 to 16 inches high was fitted over the hoop ring. After hooping the curd, the special rim was removed.

2. Hooping tank. The hooping tank was constructed of stainless steel. It was large enough to accommodate two hoops and deep enough to insure complete coverage of the curd with salted whey or salted water during hooping.

Starters

Two starters are used. One is the conventional type of lactic starter and the other is a non-hemolytic strain of Streptococcus durans, hereafter referred to as SD-A.

SD-A survives a temperature of 115° to 120° F. It grows rapidly and produces acid in milk and cheese at temperatures of 85° to 115° F, but grows slowly at curing temperatures. It also grows well in whey and curd containing 3 percent of salt and in cheese containing 1.4 to 1.7 percent of salt.

The commercial lactic starter, on the other hand, does not survive a temperature of 115° F. It produces little or no acid at temperatures above 105° F. Furthermore, it does not grow or produce acid in whey containing 3 percent salt at the hooping temperature. Therefore, both starters grow and produce acid until the curd is salted. SD-A, however, continues to grow and produce acid during hooping, pressing, and the early stage of curing.

The mother and bulk lactic starters are propagated in the conventional manner and with the usual precautions.

SD-A mother starter is propagated in either sterile skim milk or sterile reconstituted milk prepared from low-heat, spray-dried nonfat milk solids. It is transferred daily, incubated at 98° F for 16 to 18 hours, and stored at 45° to 50° F for 6 to 8 hours until the next transfer or the inoculation of bulk starter. The milk may be sterilized in either a steam-pressure autoclave or a pressure cooker for 20 minutes at 15 pounds pressure. Pyrex glassware or stainless steel containers should be used in the sterilizer.

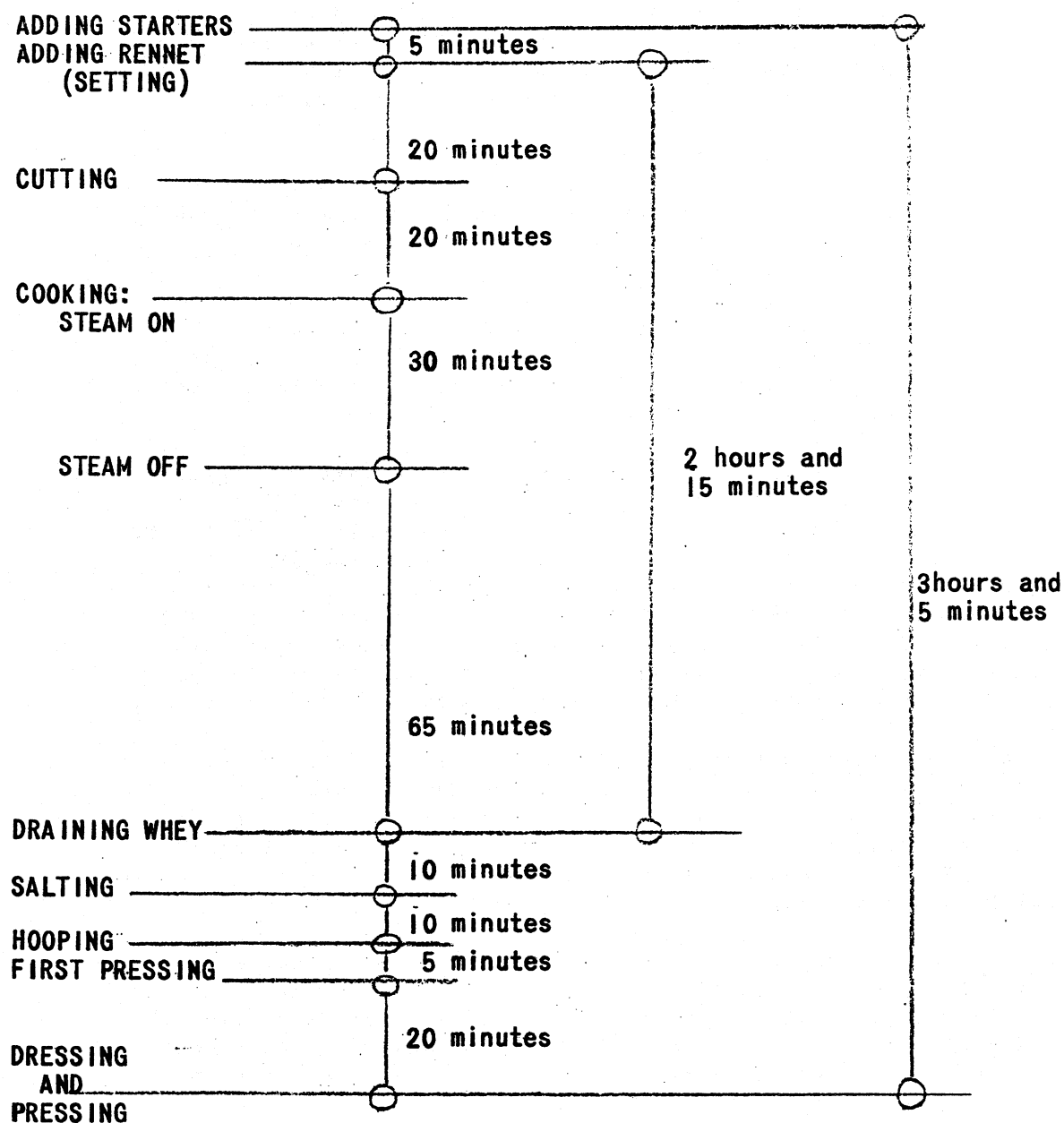
SD-A bulk starter is prepared in either skim milk or reconstituted milk that has been heated to about 180° F in flowing steam for 1-1/2 hours and cooled to 98° F. The milk is inoculated with mother starter at the rate of 1-1/4 milliliters per pound and incubated at 98° F for 16 to 18 hours. The titratable acidity of the bulk starter should be 0.50 to 0.60 percent. SD-A starter does not "set up" as well as conventional lactic starter, and it usually wheys off slightly.

Manufacturing Procedure

On the basis of the pilot-plant experiments, the following manufacturing procedure, which is outlined as a time schedule on the following page, is recommended.

1. Pasteurizing and cooling the milk.--The high-temperature, short-time method of pasteurizing (161.5 to 162° F for 15 seconds) is recommended. The cooler should be so adjusted that the milk is cooled to the setting temperature of 88° F.
2. Adding starters.--The two starters described previously are added to the milk at a temperature of 88° F in a conventional Cheddar-cheese vat. Two percent of the lactic starter and 2 percent of the SD-A starter are usually sufficient to develop the desired amount of acid during the making process so that the pH of the cheese when it is taken off the press will be from 5.1 to 5.3. If the pH is higher than 5.3, the quantity of SD-A starter should be increased in subsequent lots. If the pH is lower than 5.1, the quantity of SD-A should be decreased. The milk is stirred for 5 minutes to distribute the starters uniformly.
3. Adding rennet (setting).--Rennet and color (if used) are added 5 minutes after the addition of starters. The temperature of the milk should be 88° F. Rennet (which has been diluted with water) is added at the rate of 4 ounces for each 1,000 pounds of milk, and stirred in thoroughly. The milk coagulates (sets) into a firm curd that is ready to be cut 20 minutes after the rennet is added.
4. Cutting the curd.--The curd is cut into 1/4-inch cubes. A finer cut increases the loss of fat in the whey, and the cheese may contain less than 50 percent of fat in the solids. Immediately after the curd is cut, it is stirred continuously with the agitator to prevent clumping. Extreme care should be taken to avoid breaking the curd particles.

TIME SCHEDULE
FOR MAKING AMERICAN CHEDDAR CHEESE
FROM PASTEURIZED MILK
(3-HOUR METHOD)



5. Cooking and draining the whey.--Twenty minutes after cutting, the steam is turned on and the mixture of curd and whey is heated gradually from the setting temperature (88° F) to 100° F in 30 minutes. It is held at 100° F for one hour while stirring is continued. About 2-1/4 hours after setting, the whey is started to drain. When the whey is almost drained, 1 pound of salt per 1,000 pounds of milk is added to the curd to prevent it from clumping during forking. The curd should be kept from clumping as much as possible because clumping results in mechanical openings in the cheese. The curd is forked and the whey is drained intermittently until the curd is quite dry.

6. Salting.--Salt, at the rate of 5 pounds per 1,000 pounds of milk, is added to the curd. About one-third of the salt is added at each of three applications. The curd is stirred to distribute the salt uniformly, and it is piled to allow the salt to dissolve completely.

7. Hooping and pressing.--The bandaged hoop is placed in the hooping tank, which contains either whey or water containing 3 percent of salt at 105° to 115° F, preferably about 110° F. The level of salted liquid in the tank must be higher than the surface of the curd in the hoop. Because the curd temperature before hooping varies from 95° to 100° F, additional hot, salted whey or salted water (120° to 130° F) must be available to be added to the tank from time to time in order to maintain a temperature of about 110° F.

A weighed amount of curd is poured into the liquid in the submerged hoop. With the square hoop, the bandage is folded over, the follower is placed in the hoop, and the curd is pressed slightly by hand. With daisy, twin, or Cheddar hoops, a cap cloth and a follower are placed on the curd. During hooping, all free air entrapped between the curd particles is released and comes to the surface of the liquid. The curd-filled, perforated square hoop is removed from the liquid and pressed with a 20-pound weight for about 20 minutes. Then the cheese is removed, dressed in either a cloth or paper bandage, placed in a conventional 40-pound, square hoop, and pressed overnight in a conventional type of cheese press. With daisy, twin, or Cheddar hoops, the curd-filled hoop is removed from the liquid and pressed with a 20-pound weight. As soon as the follower has been pressed below the bandage ring, the special rim is removed and the curd is pressed in a conventional cheese press for 30 minutes. Then the cheese is removed from the press, dressed, and pressed overnight.

8. Packaging.--When the cheese has been pressed for 16 to 20 hours, it is removed from the press and prepared for packaging in the conventional manner. It may be either paraffined or wrapped in film. If the cheese is to be paraffined, it is placed in a drying room and turned once a day until the surface is dry and a rind has developed. If the cheese is to be wrapped in film, its surface must be dry because excessive leakage of moisture after wrapping results in rind rot or soft spots on the cheese during curing.

The bandage is removed from cheese that is to be wrapped in film. At packaging, the composition of the cheese is as follows: Moisture, approximately 38.0 percent; fat, approximately 31.5 percent; and salt, 1.4 to 1.7 percent.

9. Curing. --The cheese is cured under usual conditions of temperature and humidity. Excellent results have been obtained when cheese was cured either at 55° F for 3 to 4 months or at 55° F for 2 to 4 months and then at 50° F for 2 to 6 months. At these temperatures, the cheese ripens and develops flavor faster than cheese made by present methods.

10. Quality of cheese. --The cheese has a close texture and an excellent body. Very few, if any, mechanical openings are formed; thus it has a uniform weight-to-volume ratio, which is highly desirable in packaging cheese in small units. It develops a good, mild flavor in 2 to 3 months at 55° F. Slightly more flavor develops in cheese hooped in salted whey than in cheese hooped in salted water.